

## CLAIMS

What is claimed is:

1. An air cleaner for use in an air conditioning system comprising an air duct defining an airflow passage, with the air duct defining an airflow path and having a standard filter opening of a predetermined size in which a standard filter can be inserted into the airflow passage to filter the air passing through the air duct, the air cleaner comprising:
  - 5 a collector;
  - an air conditioning element; and
  - an expandable air cleaner frame carrying both the collector and the air conditioning element to form an air cleaner assembly having an effective thickness, the expandable air cleaner frame being operable between a collapsed condition, wherein the effective thickness of the air cleaner assembly is such that the air cleaner assembly can be received within the standard filter opening, and an expanded condition, wherein the effective thickness of the air cleaner assembly is greater than the standard filter opening.
- 10 2. The air cleaner according to claim 1 wherein when the expandable air cleaner frame is moved from the collapsed to the expanded condition, at least one of the collector and the air conditioning elements extended into the airflow passage along the airflow path to thereby increase the effective thickness of the air cleaner assembly.
3. The air cleaner according to claim 1 wherein the effective thickness of the air cleaner assembly is less than 1 inch when in the collapsed condition.
4. The air cleaner according to claim 1 wherein the collector comprises a layer of random fibers.
5. The air cleaner according to claim 4 wherein the random fibers are charged.

6. The air cleaner according to claim 4 wherein the collector is a low flow reducing filter.

7. The air cleaner according to claim 1 wherein the air conditioning element is a charged particle air cleaner.

8. The air cleaner according to claim 7 wherein the air conditioning element comprises an ionizing plate for generating ions to create ionized particles in the air stream.

9. The air cleaner according to claim 8 wherein the collector comprises one or more charged plates for attracting the ionized particles.

10. The air cleaner according to claim 9 wherein the air conditioning element further comprises a ground plate for directing the flow of ions from the ionizing plate.

11. The air cleaner according to claim 7 wherein the charged particle air cleaner is an electrostatic precipitator.

12. The air cleaner according to claim 7 wherein the charged particle air cleaner is an ionizer.

13. The air cleaner according to claim 1 wherein the air conditioning collector is a HEPA filter.

14. The air cleaner according to claim 1 wherein the expandable air cleaner frame comprises an expansion mechanism for moving the expandable air cleaner frame between the collapsed and expanded conditions.

15. The air cleaner according to claim 14 wherein the expansion mechanism is operable externally of the duct when the air cleaner is inserted into the duct to permit the movement of the expandable air cleaner frame from the collapsed to the expanded condition after the air cleaner is inserted within the duct.

16. The air cleaner according to claim 14 wherein the expansion mechanism displaces at least one of the collector and the air conditioning element along the airflow path to thereby change the effective thickness of the air cleaner assembly.

17. The air cleaner according to claim 16 wherein the expandable air cleaner frame comprises a peripheral frame and a carrier, with one of the collector and air conditioning element mounted to the peripheral frame and the other of the collector and air conditioning element carried by the carrier, and the expansion mechanism connecting 5 the carrier to the peripheral frame such that the expansion mechanism moves the carrier relative to the peripheral frame to move the expandable air cleaner frame between the collapsed and expanded conditions.

18. The air cleaner according to claim 17 wherein the carrier is integrally formed with the other of the collector and air conditioning element.

19. The air cleaner according to claim 17 wherein the expansion mechanism comprises at least one series of mechanical linkages for moving the expandable air cleaner frame between the collapsed and expanded conditions.

20. The air cleaner according to claim 19 wherein the at least one series of mechanical linkages is coupled with the peripheral frame and with the carrier so that displacement of the series of mechanical linkages moves the carrier relative to the expandable air cleaner frame.

21. The air cleaner according to claim 20 wherein the expansion mechanism further comprises an actuating arm for displacing the series of mechanical linkages.

22. The air cleaner according to claim 21 wherein the expansion mechanism further comprises a guide rail for directing the displacement of the series of mechanical linkages and the actuating arm.

23. The air cleaner according to claim 1 wherein the expandable air cleaner frame comprises a peripheral frame with a recess sized to receive a standard filter.

24. An expandable air cleaner frame for an air conditioning system having a duct with an opening having a predetermined size and defining an airflow path, the expandable air cleaner frame comprising:

a peripheral frame sized to be slidably received within the opening in the duct,  
5 and the peripheral frame forming a filter element recess sized to receive a filter element;  
and

10 a carrier for carrying a filter element and moveably mounted to the peripheral frame for movement between a collapsed condition, where the collective thickness of the peripheral frame and the carrier is such that they can be received within the opening in the duct, and an expanded condition, wherein the collective thickness of the peripheral frame and the carrier is greater than the opening in the duct;

wherein the expandable air cleaner frame can be inserted into the duct opening in the collapsed condition and then moved to the expanded condition to permit multiple filter elements to be inserted into the duct through the duct opening.

25. The expandable air cleaner frame according to claim 24 wherein at least a portion of the carrier is received within the filter element recess when the expandable air cleaner frame is in the collapsed condition.

26. The expandable air cleaner frame according to claim 24 wherein the peripheral frame comprises an aperture through which a filter element can be slidably inserted into the peripheral frame.

27. The expandable air cleaner frame according to claim 24 wherein during movement of the carrier from the collapsed to the expanded condition, the carrier moves into the duct in a direction along the airflow path through the duct.

28. The expandable air cleaner frame according to claim 24 and further comprising an expansion mechanism for moving the carrier between the collapsed and expanded conditions.

29. The expandable air cleaner frame according to claim 28 wherein the expansion mechanism is operable externally of the duct when the expandable air cleaner frame is inserted into the duct to permit the movement of the expandable air cleaner frame from the collapsed to the expanded condition after the expandable air cleaner frame is inserted within the duct.

30. The expandable air cleaner frame according to claim 28 wherein the expansion mechanism moves the carrier relative to the peripheral frame to thereby change the collective thickness of the peripheral frame and the carrier.

31. The expandable air cleaner frame according to claim 28 wherein the expansion mechanism comprises at least one series of mechanical linkages for moving the expandable air cleaner frame between the collapsed and expanded conditions.

32. The expandable air cleaner frame according to claim 31 wherein the at least one series of mechanical linkages is coupled with the peripheral frame and with the carrier so that displacement of the series of mechanical linkages moves the carrier relative to the peripheral frame.

33. The expandable air cleaner frame according to claim 32 wherein the expansion mechanism further comprises an actuating arm for displacing the series of mechanical linkages.

34. The expandable air cleaner frame according to claim 33 wherein the expansion mechanism further comprises a guide rail for directing the displacement of the series of mechanical linkages and the actuating arm.

35. An air conditioning system comprising:

an air duct;

an airflow passage through the air duct;

a standard filter opening of a predetermined size in the air duct and in which a

5 standard filter can be inserted into the airflow passage to filter the air passing through the air duct; and

an air cleaner;

wherein the air cleaner comprises:

10 a collector;

an air conditioning element; and

an expandable air cleaner frame carrying both the collector and the air conditioning element to form an air cleaner assembly having an effective thickness, the expandable frame being operable between a collapsed condition, wherein the effective thickness of the air cleaner assembly is such that the air cleaner assembly can be received

15 within the standard filter opening, and an expanded condition, wherein the effective thickness of the air cleaner assembly is greater than the standard filter opening.

36. The furnace according to claim 35 wherein when the expandable air cleaner frame is moved from the collapsed to the expanded condition, at least one of the collector and the air conditioning element is extended into the airflow passage along the airflow path to thereby increase the effective thickness of the air cleaner assembly.

37. The air conditioning system according to claim 35 wherein the effective thickness of the air cleaner assembly is less than 1 inch when in the collapsed condition.

38. The air conditioning system according to claim 35 wherein the collector comprises a layer of random fibers.

39. The air conditioning system according to claim 38 wherein the random fibers are charged.

40. The air conditioning system according to claim 38 wherein the collector is a low flow reducing filter.

41. The air conditioning system according to claim 35 wherein the air conditioning element is a charged particle air cleaner.

42. The air conditioning system according to claim 41 wherein the air conditioning element comprises an ionizing plate for generating ions to create ionized particles in the air stream.

43. The air conditioning system according to claim 42 wherein the collector comprises one or more charged plates for attracting the ionized particles.

44. The air conditioning system according to claim 43 wherein the air conditioning element further comprises a ground plate for directing the flow of ions from the ionizing plate.

45. The air conditioning system according to claim 41 wherein the charged particle air cleaner is an electrostatic precipitator.

46. The air conditioning system according to claim 41 wherein the charged particle air cleaner is an ionizer.

47. The air conditioning system according to claim 35 wherein the air conditioning collector is a HEPA filter.

48. The air conditioning system according to claim 35 wherein the expandable air cleaner frame comprises an expansion mechanism for moving the expandable air cleaner frame between the collapsed and expanded conditions.

49. The air conditioning system according to claim 48 wherein the expansion mechanism is operable externally of the duct when the air cleaner assembly is inserted into the duct to permit the movement of the expandable air cleaner frame from the

collapsed to the expanded condition after the air cleaner assembly is inserted within the  
5 duct.

50. The air conditioning system according to claim 48 wherein the expansion mechanism displaces one of the collector and the air conditioning element along the airflow path relative to the expandable air cleaner frame to thereby change the effective thickness of the air cleaner assembly.

51. The air conditioning system according to claim 50 wherein the expandable air cleaner frame comprises a peripheral frame and a carrier, with one of the collector and air conditioning element mounted to the peripheral frame and the other of the collector and air conditioning element carried by the carrier, and the expansion mechanism connecting the carrier to the peripheral frame such that the expansion mechanism moves the carrier relative to the peripheral frame to move the expandable air cleaner frame between the collapsed and expanded conditions.

52. The air conditioning system according to claim 51 wherein the carrier is integrally formed with the other of the collector and air conditioning element.

53. The air conditioning system according to claim 51 wherein the expansion mechanism comprises at least one series of mechanical linkages for moving the expandable air cleaner frame between the collapsed and expanded conditions.

54. The air conditioning system according to claim 53 wherein the at least one series of mechanical linkages is coupled with the peripheral frame and with the carrier so that displacement of the series of mechanical linkages moves the carrier relative to the expandable air cleaner frame.

55. The air conditioning system according to claim 54 wherein the expansion mechanism further comprises an actuating arm for displacing the series of mechanical linkages.

56. The air conditioning system according to claim 55 wherein the expansion mechanism further comprises a guide rail for directing the displacement of the series of mechanical linkages and the actuating arm.

57. The air conditioning system according to claim 35 wherein the expandable air cleaner frame comprises a peripheral frame with a recess sized to receive a standard filter.